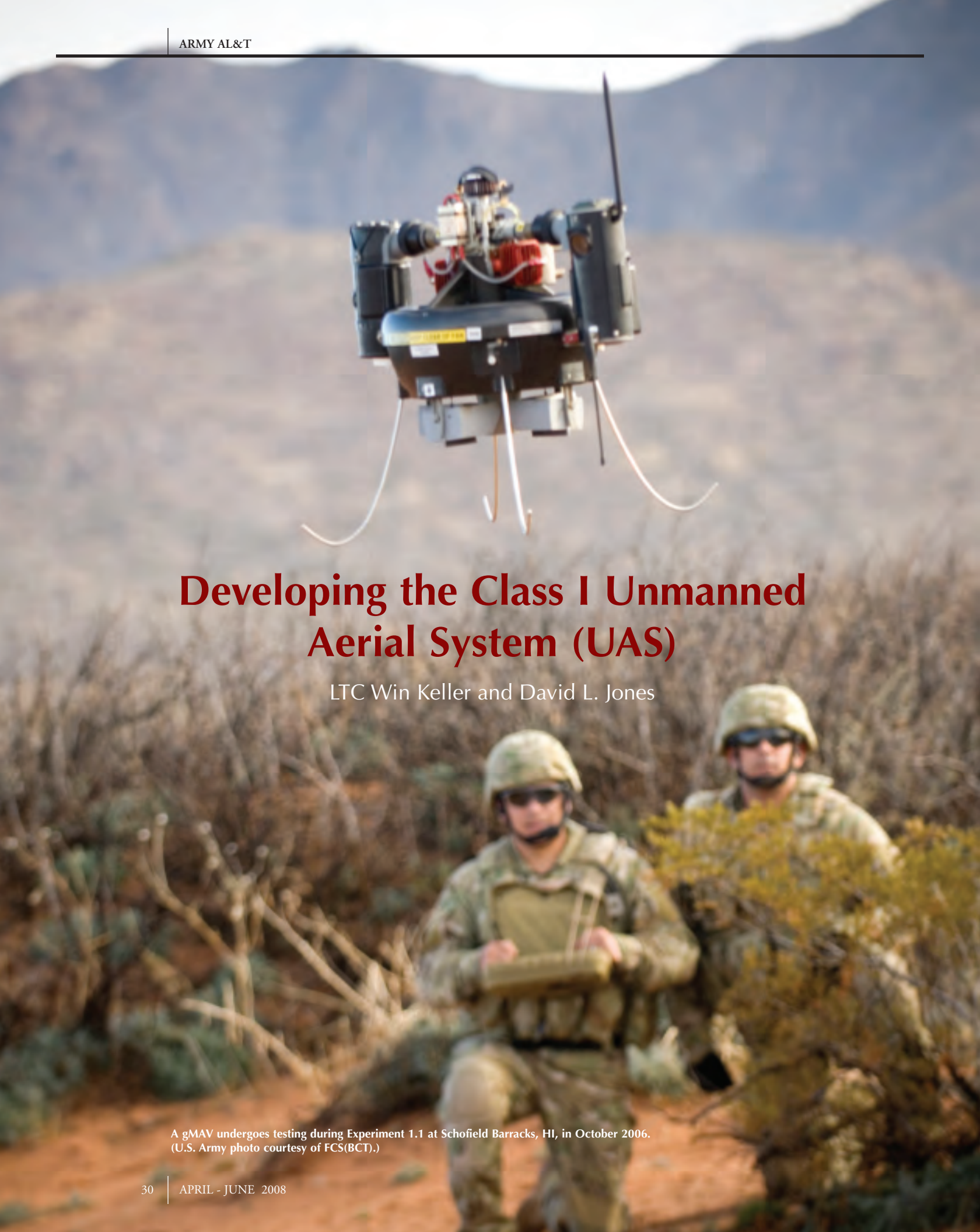

Developing the Class I Unmanned Aerial System (UAS)

LTC Win Keller and David L. Jones

A gMAV undergoes testing during Experiment 1.1 at Schofield Barracks, HI, in October 2006. (U.S. Army photo courtesy of FCS(BCT).)

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Military leaders have been seeking the bird's-eye view for warfare long before the airplane's invention. While the hot air balloon was no doubt invaluable in the Civil War, today's Soldiers need a light and practical aerial vehicle that watches without additional risk to their platoon. They need the Class I UAS. The UAS team within the Future Combat Systems (Brigade Combat Team) (FCS(BCT)) is capitalizing on the lessons learned by the Defense Advanced Research Projects Agency (DARPA) and Program Executive Office (PEO) Aviation, and using it to develop and deliver the most effective Unmanned Aerial Vehicle (UAV) as quickly as possible. In addition, FCS has implemented experiments and user tests early on in development to incorporate firsthand Soldier knowledge and experience into the Class I UAS design. Soldier input in the development phase is essential to making the Class I UAS what the platoon needs in combat.

Class I UAS

The Class I UAS is a platoon-level asset that will provide an organic, real-time reconnaissance, surveillance and target acquisition (RSTA) capability in a lightweight air vehicle (AV). The Class I UAS features a Heavy Fuel Engine (HFE) and an electro-optical (EO)/infrared (IR)/laser designator (LD)/laser range finder (LRF) sensor. The Class I UAS consists of a Class I UAV, a centralized controller and a minimal set of ancillary and support equipment.

The Class I UAS provides dismounted Soldiers with RSTA. It uses autonomous flight and navigation and will work within the FCS network. Individual Soldiers can dynamically update routes and target information. It provides dedicated reconnaissance support and early warning to the BCT Soldiers in environments not suited for larger assets. The Class I UAS provides a hover and stare capability, which is not available to Current Force UAS, enabling RSTA in urban and complex terrain. The system, which includes one AV, a control device and ground support equipment, will be transportable in two custom Modular Lightweight Load-carrying Equipment (MOLLE) packs. The Class I UAS will also be inaudible at 500 feet, have about 60 minutes of endurance and be deployable in 5 minutes.

Micro-Air Vehicle (MAV) Advanced Concept Technology Demonstration (ACTD)

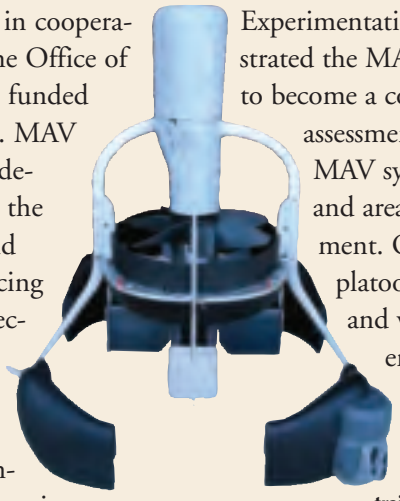
In May 2002, the Army, in cooperation with DARPA and the Office of the Secretary of Defense, funded the MAV ACTD project. MAV ACTD's purpose was to develop a UAV system that the platoon could operate and maintain, thereby enhancing the platoon's military effectiveness through greatly improved situational awareness (SA) provided through organic aerial imagery. The MAV ACTD's primary objectives were as follows:

- Establish the military utility of a backpackable, affordable, easy-to-operate and responsive reconnaissance and surveillance system through experimentation.
- Use EO/IR sensors on a small ducted fan AV, exploiting vertical flight capability to provide improved SA for Soldiers in complex terrain.
- Gain insights into the MAV's impact on doctrine, organization, tactics and modernization plans.

Test MAV (tMAV) Experimentation

The MAV system was then transitioned to the 25th Infantry Division (25ID) at Schofield Barracks, HI, for fielding. The materiel manager for the project was Project Manager UAS, PEO Aviation. After initial integration and flight testing, tMAV experimentation was conducted at the Army's Infantry Center at Fort Benning, GA, and also with the 25ID at Schofield Barracks, where the focus was on an initial assessment of the t-MAV system's military utility. Four experimentation scenarios were used: reconnaissance of military operations in urban terrain site; assault to clear a building in the Military Operations on Urban Terrain site; and route reconnaissance and convoy escort.

Experimentation clearly demonstrated the MAV system's potential to become a combat multiplier. The assessment identified both the MAV system's positive aspects and areas needing improvement. On the plus side, the platoon leader gained SA and was able to confirm enemy targets. Information gained by MAV



Shown here is the Class 1 SDD AV that AETF Soldiers trained with to prepare for experimentation in July 2008. (U.S. Army photo courtesy of FCS(BCT).)

A gMAV AV on display with its two custom MOLLE packs. (U.S. Army photo courtesy of FCS(BCT).)

resulted in changes to the course of action, demonstrated the ability to simultaneously emplace two AVs and demonstrated a 2-man team concept for deploying two MAV systems at once. Soldier input for areas needing improvement included AV endurance, Global Positioning System acquisition time, stronger data link signal/greater range and improved imagery/zoom capability. The lessons learned from this experiment led to enhancements in the next MAV iteration — the gasoline engine MAV (gMAV).

A USN explosive ordnance disposal unit deployed with the gMAV and conducted an in-theater assessment. While official results are not available, initial indications are that the system performed well.

gMAV

After upgrades and improvements, the gMAV was sent to Schofield Barracks in October 2006 for the formal MAV ACTD Military Utility Assessment (MUA). The MUA was considered a success, as indicated by the following feedback received from Soldiers who participated:

- "Provides significant military utility to the lowest echelon."
- "Very easy to operate."
- "Operating in conjunction with the Stryker … the MAV significantly contributed to persistent surveillance."

Follow-On Efforts to the MAV ACTD

Lessons learned from the MUA are being used to develop the Class I and accelerate the Class I Block 0 UAS to the Army Evaluation Task Force (AETF) for Concept of Operations (CONOPS) and to develop the necessary tactics, techniques and procedures (TTPs). The Class I Block 0 UAS will be based on the gMAV airframe with numerous upgrades, including a sensor gimbal, networked radios, improved user interface, remote start and launch, and an electric refueling. Additional congressional funding provided to the Program Manager FCS(BCT) and the U.S. Navy (USN) was leveraged to make these critical upgrades.

DARPA has funded a 5-horsepower HFE for the Class I UAS. The engine has completed more than 62 hours of bench operation. Four prototypes were delivered in January 2008. The 4-stroke engine will provide safer operation, reduced noise and improved endurance with a common fuel.

The gMAV has received an experimental flight certificate from the Federal Aviation Administration, allowing operations within controlled national airspace (NAS). Several civil law enforcement agencies are experimenting with the gMAV. These efforts will expand the understanding and application of unmanned systems in the NAS.

A USN explosive ordnance disposal unit deployed with the gMAV and conducted an in-theater assessment. While official results are not available, initial indications are that the system performed well.

The 25ID continues to train with and use the gMAV. The unit deployed with the gMAV to the National Training Center at Fort Irwin, CA, in late summer 2006, while preparing for deployment to theater. Their request to deploy to Iraq with the gMAV was approved.

FCS(BCT) Experiment 1.1

FCS(BCT) Experiment 1.1, which paired the design engineers with combat veterans who had recently deployed to Iraq and Afghanistan, was held in March 2007. Bringing Soldiers into the development phase with live training has allowed essential user feedback early in the design phase. Along with the gMAV, the experiment included the FCS network, Urban and Tactical Ground Sensors, and the Small Unmanned Ground Vehicle. The gMAV was used within the FCS network to perform reconnaissance and target identification, including sending data to FCS ground vehicles and manned/unmanned teaming with Apache helicopters. Soldiers stressed that this technology would be so beneficial in theater that they'd take it "as is." Other feedback included the following:

- "The IR sensor pinpointed the enemy even after the sun went down. We could have really used this in Iraq."
- "The UAV helped us identify a breech during the exercise. If this had been real combat, it would have saved lives."
- "Class I UAV would have saved lives in Iraq because we could have seen over walls. It would have protected our resupply squad."

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Class I Block 0 Acceleration

As both a risk reduction program for the FCS Class I UAS System Development and Demonstration (SDD) and a way to accelerate Class I to the field, the FCS program has begun an effort to accelerate Class I Block 0 UAS development. The AETF at Fort Bliss, TX, began receiving training on the systems in February 2008, which will lead to an experiment scheduled for July 2008. The acceleration effort's focus is to get the system in the hands of Soldiers to aid in the development of CONOPS and TTPs for the Class I Block 0 system and for Class I UAS SDD risk reduction. This effort will also provide a great opportunity to gain invaluable insight from Soldiers on system operations and functionality. The feedback can then be used to develop vehicle enhancements and improvements rapidly. During a demonstration conducted in mid-January 2008 at Fort Bliss, AETF Soldiers had their first chance to execute a tactical scenario incorporating sensor imagery from the Class I AV. The Soldiers were extremely impressed by the imagery that provided them a significantly increased SA level before dismounting their vehicles.

A 25ID Soldier operates a gMAV during Experiment 1.1 testing. (U.S. Army photo courtesy of FCS(BCT).)

Originally, the Class I UAS was to have only an EO/IR sensor. With the deferment of Class II and Class III UAS to objective requirement and the MAV ACTD MUA findings, the Class I UAS was redesigned with an EO/IR/LD/LRF sensor and an increase in altitude. The Class I UAS propulsion system is also being redesigned to use a larger HFE to accommodate the EO/IR/LD/LRF payload.

Key acquisition and test milestones for the Class I are a Preliminary Design Review in late 2008 and a Critical Design Review in late 2009. Risk reduction flight of the AV will be conducted in late 2009, with a first flight of the integrated Class I UAS in 2011. Initial Operating Capability and Full Operational Capability are aligned with the FCS program and will be in 2015 and 2017, respectively.

LTC WIN KELLER is the Product Manager Future Force (FF) UAS. He has a B.S. in business from Northeast Louisiana University. Keller is an Army Acquisition Corps (AAC) member and is Level III certified in program management.

DAVID L. JONES is the Class I UAS Lead for the FF UAS. He has a B.S. in electrical engineering and an M.S. in industrial and systems engineering, both from the University of Alabama-Huntsville. Jones is an AAC member and is certified Level III in systems engineering/systems planning, research, development and engineering; production, quality and manufacturing; and program management; and Level I in test and evaluation.